

California Department of Public Health

Carbapenem-Resistant Enterobacteriaceae

Quicksheet



CDPH recommends a coordinated approach among healthcare facilities and public health to contain carbapenem-resistant Enterobacteriaceae (CRE) in California. Local health departments (LHD) should be aware of CRE incidence in healthcare facilities and communities in their regions, understand prevention measures, and provide guidance to healthcare facilities when responding to CRE reports.

Background

- CRE are bacteria of the Enterobacteriaceae family (e.g., *Klebsiella pneumoniae*, *E. coli*, *Enterobacter* spp.) that are resistant to the carbapenem antibiotics such as meropenem.
- Carbapenemase enzymes that inactivate carbapenems include KPC, NDM, OXA-48, VIM, and IMP.¹ KPC is the most commonly identified carbapenemase in the United States.

- CP-CRE is laboratory reportable in California.^{2,3}

CP-CRE Reporting Requirements

1. Labs that perform carbapenemase testing, or use a public health or reference lab to obtain carbapenemase testing, will report the following:

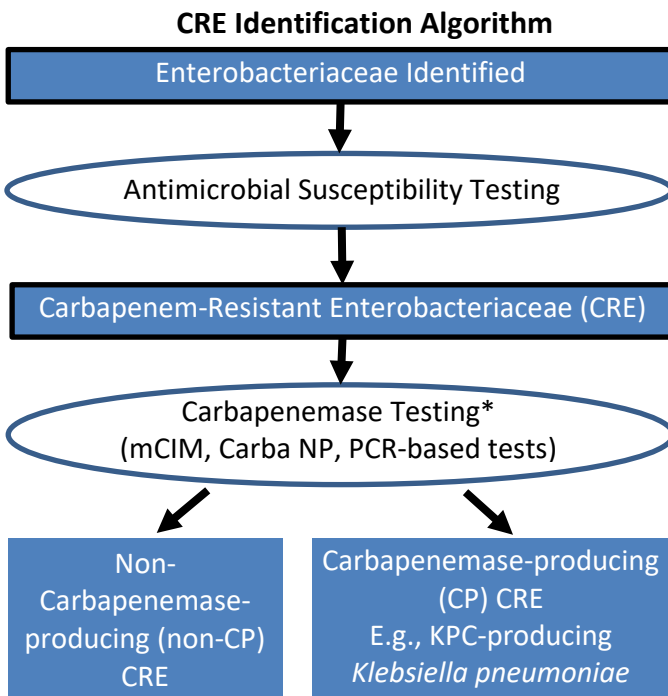
Any *Enterobacter* spp., *Escherichia coli*, or *Klebsiella* spp. where the isolate is:

- Positive for carbapenemase production by a **phenotypic** method
- OR-
- Positive for a known carbapenemase resistance mechanism (KPC, NDM, OXA-48, VIM, IMP, novel carbapenemase) by a **molecular** test

2. Labs that do not perform or obtain carbapenemase testing, will report the following:

Any *Enterobacter* spp., *Escherichia coli*, or *Klebsiella* spp. from any site, resistant to any carbapenem.

- CDPH recommends clinical labs perform or access carbapenemase testing to distinguish CP-CRE from non-CP-CRE. Carbapenemase testing is available at some local public health labs and CDPH Microbial Diseases Laboratory (MDL).⁴



*Phenotypic tests identify whether an isolate produces a carbapenemase; molecular tests identify the specific type of carbapenemase present

¹*Klebsiella pneumoniae* carbapenemase (KPC), New Delhi Metallo- β -Lactamase (NDM), Oxacillinase (OXA-48 like), Verona Integron Metallo- β -Lactamase (VIM) and Imipenemase (IMP)

² CDPH Reportable Diseases and Conditions: <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Reportable-Disease-and-Conditions.aspx>

³ CDC Case Definition:

<https://www.cdc.gov/nndss/conditions/carbapenemase-producing-carbapenem-resistant-enterobacteriaceae/>

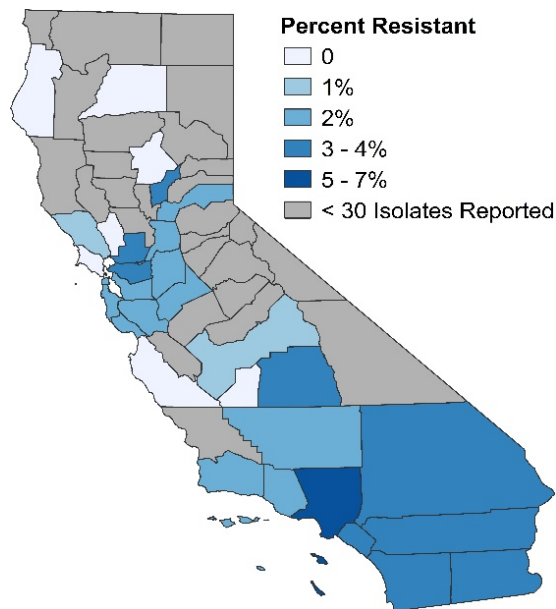
⁴ Carbapenemase Testing at CDPH MDL:

https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CA_AR_LabNetwork_CarbapenemaseTestingAtCDPH_%20110817-ADA.pdf

CRE Epidemiology

- CRE prevalence among healthcare-associated infections (HAI) in hospitals varies widely by region.

CRE among Isolates Reported to the National Healthcare Safety Network (2014-2017)⁵



Regional CRE Prevalence Definitions⁶

Prevalence	Definition
High or endemic	CRE are routinely identified; e.g., hospitals have >1 case a month
Lower prevalence	CRE identified with regularity; e.g., hospitals have 3-12 cases a year
Very low prevalence	CRE rarely identified; e.g., hospitals have 1 or 2 cases a year

- Long-term acute care hospitals (LTACH) and skilled nursing facilities that provide ventilator care (vSNF) have the highest CRE prevalence.⁷
- Infections caused by CRE that produce carbapenemases (CP-CRE) can be very difficult to treat, and mortality rates for invasive infections are as high as 50%.

- CP-CRE are highly transmissible in healthcare settings. Infected and colonized patients can serve as sources of transmission.
- Risk factors for CP-CRE acquisition include healthcare exposures outside of the United States, antimicrobial treatment, and presence of indwelling medical devices such as urinary catheters and endotracheal tubes.
- Containing CP-CRE is a public health priority because carbapenemases can spread within and between bacterial species. The rising prevalence of CRE in the United States is largely attributed to CP-CRE. **CDPH recommends LHD focus containment efforts on CP-CRE.**

Facility Actions

1. Routine Surveillance

- Clinical labs immediately notify clinicians and infection prevention staff when CRE are identified from clinical specimens.
- When carbapenemase mechanism is unknown, perform or access carbapenemase testing.

2. Active Surveillance

- Healthcare facilities screen for CP-CRE and implement preemptive Contact precautions for patients at risk for CP-CRE, including patients:
 - admitted from LTACH
 - admitted from facilities known to have ongoing CP-CRE transmission
 - epidemiologically linked to a newly-identified CP-CRE case
 - with history of receiving healthcare outside the United States during the past 12 months.

3. Investigation

- Establish baseline CP-CRE incidence at the facility; e.g., determine the number of patients newly identified with CP-CRE per month.
- Use thresholds for investigation and reporting of CRE in acute care hospitals, LTACH, and vSNF; one

⁵ Rizzo K, Horwich-Scholefield S, Epton E. Carbapenem and Cephalosporin Resistance among Enterobacteriaceae in Healthcare-Associated Infections, California, USA. *Emerg Infect Dis* 2019;25(7):1389-1393.

⁶ CORHA Proposed Definitions: <https://corha.org/resources-and-products/>

⁷ McKinnell JA, Singh RD, Miller LG, et al. The SHIELD Orange County Project: Multidrug-resistant Organism Prevalence in 21 Nursing Homes and Long-term Acute Care Facilities in Southern California, *Clin Infect Dis* 2019.

CRE case is the threshold for all other facility types. Report unusual infectious disease occurrences and outbreaks to public health and CDPH Licensing & Certification if in licensed healthcare facility.^{8,9}

Facility Thresholds for Investigation and Reporting⁶

Threshold level	Investigate at facility	Notify public health
High/endemic		
1 non-KPC CP-CRE	√	√
Same organism within 4 weeks: <ul style="list-style-type: none"> • 2 KPC-CRE -OR- • 2 CP-CRE (unknown mechanism) -OR- • 2 CRE (non-CP or CP testing not performed) 	√ when on same unit	√ when epi-linked**
Lower		
1 CP-CRE	√	√
2 CRE (non-CP or CP testing not performed), same organism within 4 weeks	√ when on same unit	√ when epi-linked**
Very low		
1 CRE	√	√

** Epi-linked: common primary or consultative service, healthcare personnel (HCP), bathroom, procedure, or device.

Public Health Response to CRE Reports

1. Initial Response and Recommendations

LHD makes recommendations to the facility for information gathering, surveillance, and infection control measures.

- Complete relevant information in the CalREDIE case report form, including:
 - Previous/subsequent healthcare facilities
 - Date of admission/discharge

- Locations (e.g., units, wings)
- Indwelling devices/procedures
- Specimen collection dates, sources and results
- Healthcare exposures outside the United States in the previous 12 months

- Recommend placing patient in a single-bed room on Contact precautions.
- Ensure transferring facilities inform receiving facilities of patient's CRE status at time of transfer.

2. Retrospective and Prospective Lab Surveillance

- Conduct retrospective surveillance to identify additional cases during the previous 6 months.
- Request clinical lab retain all CRE isolates for further characterization for at least 3 months.
- Recommend facility perform or access carbapenemase testing if not already done.

3. Contact Investigation

- In consultation with CDPH HAI Program, recommend CP-CRE colonization testing of epidemiologically-linked patient contacts, including those:
 - who shared a bathroom and roommates
 - with shared primary HCP, or exposed to the same device (e.g., duodenoscope)
 - not previously identified with CP-CRE residing on unit(s) where transmission is suspected (point prevalence survey (PPS))
- If one or more additional patients are identified with CP-CRE, conduct serial PPS at 2-week intervals until 2 consecutive PPS are completely negative.
- CP-CRE colonization testing of rectal swab specimens is available at no cost to facilities via the CDC Antibiotic Resistance Laboratory Network (ARLN).¹⁰

⁸ All Facilities Letter:

<https://www.cdph.ca.gov/Programs/CHCQ/LCP/CDPH%20Document%20Library/AFL-19-18.pdf>

⁹ Licensing and Certification District Offices Directory:

<https://www.cdph.ca.gov/Programs/CHCQ/LCP/Pages/DistrictOffices.aspx>

¹⁰ California Antimicrobial Resistance Lab Network Webinar:

https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/California_AR_Lab_Network_Overview_of_CDC_ARLN_11.15.16_ADA092917.pdf

4. Infection Control Recommendations for Facilities

Room Placement

- Place patients infected or colonized with CP-CRE in a single-bed room whenever possible, and implement Contact precautions.
- In facilities with multi-bed rooms, place patients with CP-CRE with the same carbapenemase in the same room, whenever possible.
- In multi-bed rooms, treat each bed space as a separate room. HCP must change gown and gloves and perform hand hygiene between contact with patients in the same room.

Transmission-based Precautions

- Contact precautions consist of HCP use of gowns and gloves upon entry to the patient room; patients may only leave room when medically necessary.
- Continue Contact precautions for the duration of admission in acute care hospitals, including LTACH.
- In SNF, once there is no longer evidence of transmission, implement Enhanced Standard Precautions for residents with risk factors for transmission.¹¹
- Do not perform repeated bacterial cultures to demonstrate CRE “clearance”, as CRE may be shed intermittently and patients may remain colonized for more than six months.

Dedicated Staff and Equipment

- Dedicate daily care equipment as much as possible, and consider using single-use, disposable, non-critical devices.

If multiple CP-CRE infected or colonized patients are present in a healthcare facility:

- Place them in rooms in the same geographic area of the facility whenever possible.
- Dedicate primary HCP (e.g., nursing) without responsibility to care for non-CP-CRE patients.
 - HCP who cannot be dedicated to CP-CRE patients should care for non-CP-CRE patients before CP-CRE patients, whenever feasible.

Environmental Cleaning

- Clean and disinfect non-dedicated equipment after use, and high-touch surfaces with an Environmental Protection Agency (EPA)-approved healthcare grade disinfectant at regular intervals.

Adherence Monitoring

- Evaluate implementation of infection control measures using adherence monitoring tools and provide feedback to HCP.¹²

LHD may consult with CDPH HAI Program to determine need to conduct on-site infection control assessment.

5. Communication

- When transferring a CRE-infected or -colonized patient to another healthcare facility, the transferring facility must communicate the patient’s CRE status to the receiving facility at time of transfer.¹³
- Facilities with ongoing CRE outbreaks should inform facilities to which they transfer patients. Receiving facilities may screen such patients for CRE and place them in pre-emptive Contact precautions pending the culture result.
- Flag the medical record of patients with CRE within each facility to ensure infection control precautions are implemented upon readmission.
- Provide education materials to patients, their families, and HCP as needed.¹⁴

¹¹ CDPH Enhanced Standard Precautions for SNF:

<https://www.cdph.ca.gov/Programs/CHCQ/LCP/CDPH%20Document%20Library/Enhanced-Standard-Precautions.pdf>

¹² CDPH Tools for Monitoring Adherence to Health Care Practices that Prevent Infection:

<https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/MonitoringAdherenceToHCPPracticesThatPreventInfection.aspx>

¹³ Infection Control Transfer Form:

<https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/Interfacility%20Transfer%20Form%20061417.pdf>

¹⁴ CDPH CRE Website:

[https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/Carbapenem-resistantEnterobacteriaceae\(CRE\).aspx](https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/Carbapenem-resistantEnterobacteriaceae(CRE).aspx)